CLAIMS

1. A method of making a material alloy for an R-T-Q based rare-earth magnet, the method comprising the steps of:

preparing a melt of an R-T-Q based rare-earth alloy, where R is rare-earth elements, T is a transition metal element, Q is at least one element selected from the group consisting of B, C, N, Al, Si and P, and the rare-earth elements R include at least one element R_L selected from the group consisting of Nd, Pr, Y, La, Ce, Pr, Sm, Eu, Gd, Er, Tm, Yb and Lu and at least one element R_H selected from the group consisting of Dy, Tb and Ho;

cooling the melt of the alloy to a temperature of 700 °C to 1,000 °C as first cooling process, thereby making a solidified alloy;

maintaining the solidified alloy at a temperature within the range of 700 °C to 900 °C for 15 seconds to 600 seconds; and

cooling the solidified alloy to a temperature of 400 °C or less as a second cooling process.

2. The method of claim 1, wherein the step of maintaining the solidified alloy at a temperature within the range includes the step of decreasing the temperature of the solidified alloy at a temperature decrease rate of 10 °C /min or less or the step of increasing the temperature

of the solidified alloy at a temperature increase rate of 1 °C /min or less.

3. The method of claim 1, wherein the first cooling process includes the step of decreasing the temperature of the alloy at a cooling rate of 10^2 °C /s to 10^4 °C /s.

4. The method of claim 1, wherein the second cooling process includes the step of decreasing the temperature of the alloy at a cooling rate of 10 °C /s or more.

5. The method of claim 1, wherein the element R_H accounts for at least 5 at% of the rare-earth elements included.

6. The method of claim 1, wherein just after the second cooling process is finished, the atomicity ratio of the element R_H included in the $R_2T_{14}Q$ phase of the solidified alloy is higher than that of the element R_H to the overall rare-earth elements.

7. The method of claim 1, wherein just after the second cooling process is finished, the atomicity ratio of the element R_H included in the $R_2T_{14}Q$ phase of the solidified alloy is more than 1.1 times as high as that of the element R_H to the overall rare-earth elements.

8. The method of claim 1, wherein the rare-earth elements R account for 11 at% to 17 at% of the overall alloy, and

wherein the transition metal element T accounts for 75 at% to 84 at% of the overall alloy, and

wherein the element Q accounts for 5 at% to 8 at% of the overall alloy.

9. The method of claim 1, wherein the alloy further includes at least one additional element M that is selected from the group consisting of Ti, V, Cr, Mn, Ni, Cu, Zn, Ga, Zr, Nb, Mo, In, Sn, Hf, Ta, W and Pb.

10. The method of claim 1, wherein the first cooling process includes the step of cooling the melt of the alloy with a rotating chill roller.

11. The method of claim 1, wherein the step of maintaining includes the step of transferring heat from a member that has been heated to a temperature of 700 °C to 900 °C to the rapidly cooled alloy.

12. A method of making a material alloy powder for an R-T-Q based rare-earth magnet, the method comprising the steps of:

decrepitating the R-T-Q based rare-earth magnet material alloy, which has been made by the method of one of claims 1 to 11, by a hydrogen decrepitation process; and

pulverizing the R-T-Q based rare-earth magnet material alloy that has been decrepitated.

13. The method of claim 12, wherein the step of pulverizing the R-T-Q based rare-earth magnet includes finely pulverizing the R-T-Q based rare-earth magnet with a high-speed airflow of an inert gas.

14. A method for producing a sintered magnet, the method comprising the steps of

preparing the R-T-Q based rare-earth magnet material alloy powder by the method of claim 12 or 13 and making a compact of the powder, and

sintering the compact.

15. The method of claim 14, wherein the step of sintering the compact includes controlling a temperature increase rate at 5 °C /min or more when the compact is heated from a temperature of 800 °C, at which a liquid phase is produced, to a temperature, at which sintered

density reaches a true density, after a dehydrogenation process is finished.

16. An R-T-B based rare-earth magnet material alloy made by the method of claim 1, the alloy comprising a main phase and an R-rich phase,

wherein the concentration of the element R_H in a portion of the R-rich phase, which is in contact with an interface between the main phase and the R-rich phase, is lower than that of the element R_H in a portion of the main phase, which is also in contact with the interface, and

wherein crystal grains that form the main phase have minor-axis sizes of 3 μm to 10 μm.